PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference CH920030062	**FOR FURTHER ACTION** See Form PCT/IPEA/416	
International application No. PCT/IB2004/003799	International filing date *(day/month/year)* 19.11.2004	Priority date *(day/month/year)* 06.01.2004
International Patent Classification (IPC) or national classification and IPC H04L27/26, G06F17/14		
Applicant INTERNATIONAL BUSINESS MACHINES CORPORATION et al.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 6 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand 03.11.2005	Date of completion of this report 14.03.2006
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Koukourlis, S Telephone No. +31 70 340-2285

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IB2004/003799

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:

   ☐ international search (under Rules 12.3 and 23.1(b))
   ☐ publication of the international application (under Rule 12.4)
   ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages	
1-17	as originally filed
Claims, Numbers	
1-18	received on 22.02.2006 with letter of 22.02.2006
Drawings, Sheets	
1/4-4/4	as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

   ☐ the description, pages
   ☐ the claims, Nos.
   ☐ the drawings, sheets/figs
   ☐ the sequence listing *(specify)*:
   ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

   ☐ the description, pages
   ☐ the claims, Nos.
   ☐ the drawings, sheets/figs
   ☐ the sequence listing *(specify)*:
   ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IB2004/003799

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-18
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-18
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-18
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following document:

D1: EP-A2-0 668 678 (ITALTEL SOCIETA ITALIANA TELECOMUNICAZIONI S.P.A) 23 August 1995 (1995-08-23)

D2: E CHU ET AL: "Inside the FFT black box" [Online] 2000, CRC PRESS , BOCA RATON , XP002314648 Retrieved from the Internet: URL:http://www.engnetbase.com/books/735/02 70_pdf_toc.pdf> [retrieved on 2005-01-24]

D3: R MATUSIAK: "Implementing Fast Fourier Transform Algorithms of Real-Valued Sequences with the TMS320 DSP Family" TEXAS INSTRUMENTS, APPLICATION REPORT SPRA291, December 1997 (1997-12), XP002314647 Retrieved from the Internet: URL:http://www.eetkorea.com/ARTICLES/2001M AY/2001MAY07_DSP_EMS_AN.PDF> [retrieved on 2005-01-24]

D4: BOTARO HIROSAKI: "AN ORTHOGONALLY MULTIPLEXED QAM SYSTEM USING THE DISCRETE FOURIER TRANSFORM" IEEE TRANSACTIONS ON COMMUNICATIONS, IEEE INC. NEW YORK, US, vol. 29, no. 7, July 1981 (1981-07), pages 982-989, XP000568062 ISSN: 0090-6778

The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses (see fig. 3):
a method for modulating sub-carrier symbols to an intermediate frequency OFDM signal comprising the steps of preprocessing (data staggering and premodulation, see col. 6, lines 1-32), performing a complex N-point IDFT, and further processing by using Hermitian Symmetry Extractors, filtering and parallel-to-serial conversion.

The subject-matter of claim 1 differs from this known method in that it performs a pre-processing according to the function given in claim 1 which performs a transformation into a symmetric frequency spectrum.

Thanks to this preprocessing, only a simple multiplexing is needed after the IDFT stage,

contrary to the much more complex transformations which take place in D1 after the IDFT.

The subject-matter of claim 1 is therefore new (Article 33(2) PCT).

The problem to be solved by the present invention may therefore be regarded as how to reduce the complexity of the system.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:
none of the cited documents discloses or suggests a preprocessing that creates a symmetric frequency spectrum such that after the IDFT a simple multiplexing of the real and imaginary parts of the complex output symbols into even and odd samples can produce the intermediate frequency OFDM signal.

Documents D2 and D3 only disclose the mathematical principle that a single N-point complex FFT can be used to evaluate two N-point real FFTs or one 2N-point real FFT which is a sub-aspect of the invention, but give no hint as to using the combination of a symmetric frequency spectrum with a simple multiplexing as mentioned above for the production of an intermediate frequency OFDM signal.

Document D4 also discloses a different and more complex OFDM system employing filtering after the IDFT stage.

The same reasoning applies, mutatis mutandis, to the subject-matter of the corresponding independent claims 4 (method for demodulating), 9 (modulator) and 14 (demodulator).

Claims 2-3, 5-8, 10-13 and 15-18 are dependent on claims 1, 4, 9 and 14 respectively and as such also meet the requirements of the PCT with respect to novelty and inventive step.